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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/585,732	07/12/2006	Toshio Hasegawa	293375US26PCT	6041
22850	7590	05/07/2009		
OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, P.C. 1940 DUKE STREET ALEXANDRIA, VA 22314			EXAMINER NGUYEN, KHIEM D	
			ART UNIT	PAPER NUMBER
			2823	
			NOTIFICATION DATE	DELIVERY MODE
			05/07/2009	ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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<b>Office Action Summary</b>	<b>Application No.</b> 10/585,732	<b>Applicant(s)</b> HASEGAWA, TOSHIO	
	<b>Examiner</b> KHIEM D. NGUYEN	<b>Art Unit</b> 2823	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 09 April 2009.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-18, 21, 24-27, 30, 33 and 35 is/are pending in the application.
- 4a) Of the above claim(s) 17, 18, 21, 24-27, 30, 33 and 35 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-16 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 July 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>10/11/2006</u> .  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Election/Restrictions***

1. Applicant's election of Group I, Species I (claims 1-16) in the reply filed on April 09<sup>th</sup>, 2009 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)). Claims 17, 18, 21, 24-27, 30, 33 and 35 withdrawn from further consideration by the Examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

### ***Oath/Declaration***

2. The Oath/Declaration filed on July 12<sup>th</sup>, 2006 is acceptable.

### ***Priority***

3. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

### ***Preliminary Amendment***

4. The preliminary amendment filed on July 12<sup>th</sup>, 2006 has been entered.

### ***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Eichman et al. (U.S. Patent 5,279,857).

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In re claim 1, **Eichman et al.** disclose a film formation method for forming a metal nitride film (titanium nitride) having a predetermined thickness on a target substrate by heating the target substrate at a film formation temperature within a process container and performing a cycle comprising a first step and a second step at least once, such that the first step is arranged to supply a metal compound gas ( $\text{TiCl}_4$ ) and a nitrogen-containing reducing gas ( $\text{NH}_3$ ) to form a film of a metal nitride by CVD (see col. 2, lines 26-64), and the second step is arranged to stop the metal compound gas and supply the nitrogen-containing reducing gas (see col. 1, line 58 to col. 2, line 16), wherein, in film formation, the target substrate is set at a temperature of about 600 to 700°C (see col. 3, lines 3-20), the process container is set to have therein a total pressure of about 115 mTorr to 300 mTorr (approximately 15.332 Pa to about 39.997 Pa) (see col. 3, lines 3-20), and the nitrogen-containing reducing gas is set to have a predetermined partial pressure within the process container in the first step (see col. 3, lines 3-20).

**Eichman et al.** do not specifically disclose that the target substrate is set at a temperature of less than 450°C, the process container is set to have therein a total pressure of more than 100 Pa and the nitrogen-containing reducing gas is set to have a partial pressure of 30 Pa or less within the process container in the first step.

However, there is no evidence indicating the temperature range at which the target substrate is set, the total pressure range of the process container and

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the partial pressure range of the nitrogen-containing reducing gas is critical and it has been held that it is not inventive to discover the optimum or workable range of a result-effective variable within given prior art conditions by routine experimentation. See MPEP § 2144.05. Note that the specification contains no disclosure of either the critical nature of the claimed dimensions of any unexpected results arising there from. Where patentability is aid to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of Applicant's claimed invention was made to optimize the temperature range of the target substrate, the total pressure range and the partial pressure range of **Eichman et al.** by routine experimentation in order to achieve a low resistivity titanium nitride film (see Abstract).

In re claims 2-6, **Eichman et al.** do not specifically disclose wherein a film thickness obtained by the cycle performed once is set to be 0.50 nm or less, wherein, in the first step, the nitrogen-containing reducing gas is set to have a partial pressure of 20 Pa or less within the process container, wherein a film thickness obtained by the cycle performed once is set to be 2.0 nm or less, wherein, in the first step; the nitrogen-containing reducing gas is set to have a partial pressure of 15 Pa or less within the process container and wherein, in film formation, the target substrate is set at a temperature of 400°C or less.

However, there is no evidence indicating the film thickness range obtained by the cycle performed once, the partial pressure range of the nitrogen-containing reducing gas, and the temperature range of the target substrate is critical and it has been held that it is not inventive to discover the optimum or workable range of a result-effective variable within given prior art conditions by routine experimentation. See MPEP § 2144.05. Note that the specification contains no disclosure of either the critical nature of the claimed dimensions of any unexpected results arising there from. Where patentability is aid to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of Applicant's claimed invention was made to optimize the film thickness range obtained by the cycle performed once, the partial pressure range of the nitrogen containing reducing gas, and the temperature range of the target substrate of **Eichman et al.** by routine experimentation in order to achieve a low resistivity titanium nitride film (see Abstract).

In re claim 7, **Eichman et al.** a film formation method for forming a TiN film having a predetermined thickness on a target substrate by heating the target substrate at a film formation temperature within a process container and performing a cycle comprising a first step and a second step at least once, such that the first step is arranged to supply a Ti compound gas (TiCl<sub>4</sub>) and a nitrogen-

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containing reducing gas ( $\text{NH}_3$ ) to form a film of TiN by CVD (see col. 2, lines 26-64), and the second step is arranged to stop the Ti compound gas and supply the nitrogen-containing reducing gas (see col. 1, line 58 to col. 2, line 6), wherein, in film formation, the target substrate is set at a temperature of about 600 to 700°C (see col. 3, lines 3-20), the process container is set to have therein a total pressure of of about 115 mTorr to 300 mTorr (approximately 15.332 Pa to about 39.997 Pa) (see col. 3, lines 3-20), and the nitrogen-containing reducing gas is set to have a predetermined partial pressure within the process container in the first step (see col. 3, lines 3-20).

**Eichman et al.** do not specifically disclose that the target substrate is set at a temperature of less than 450°C, the process container is set to have therein a total pressure of more than 100 Pa and the nitrogen-containing reducing gas is set to have a partial pressure of 30 Pa or less within the process container in the first step.

However, there is no evidence indicating the temperature range at which the target substrate is set, the total pressure range of the process container and the partial pressure range of the nitrogen-containing reducing gas is critical and it has been held that it is not inventive to discover the optimum or workable range of a result-effective variable within given prior art conditions by routine experimentation. See MPEP § 2144.05. Note that the specification contains no disclosure of either the critical nature of the claimed dimensions of any unexpected results arising there from. Where patentability is aid to be based

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upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of Applicant's claimed invention was made to optimize the temperature range of the target substrate, the total pressure range and the partial pressure range of **Eichman et al.** by routine experimentation in order to achieve a low resistivity titanium nitride film (see Abstract).

In re claim 8, as applied to claim 1 above, **Eichman et al.** disclose all claimed limitations including the limitation wherein the Ti compound gas is  $\text{TiCl}_4$  and the nitrogen-containing reducing gas is  $\text{NH}_3$  (see col. 2, lines 26-34).

In re claims 9-13 and 15-16, **Eichman et al.** do not specifically disclose wherein a film thickness obtained by the cycle performed once is set to be 0.50 nm or less, wherein, in the first step, the nitrogen-containing reducing gas is set to have a partial pressure of 20 Pa or less within the process container, wherein a film thickness obtained by the cycle performed once is set to be 2.0 nm or less, wherein, in the first step, the nitrogen-containing reducing gas is set to have a partial pressure of 15 Pa or less within the process container, wherein, in film formation, the target substrate is set at a temperature of  $400^\circ\text{C}$  or less, wherein, in the first step, the Ti compound gas is set to have a partial pressure of more than 10 Pa and not more than 50 Pa, and wherein the TiN film is set to have a resistivity of  $800 \mu\Omega\cdot\text{cm}$  or less.



However, there is no evidence indicating the film thickness range obtained by the cycle performed once, the partial pressure range of the nitrogen-containing reducing gas, the temperature range of the target substrate, the partial pressure range of the Ti compound gas and the resistivity of the TiN film is critical and it has been held that it is not inventive to discover the optimum or workable range of a result-effective variable within given prior art conditions by routine experimentation. See MPEP § 2144.05. Note that the specification contains no disclosure of either the critical nature of the claimed dimensions of any unexpected results arising there from. Where patentability is aid to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of Applicant's claimed invention was made to optimize the film thickness range obtained by the cycle performed once, the partial pressure range of the nitrogen containing reducing gas, the temperature range of the target substrate, the partial pressure range of the Ti compound gas, and the resistivity of the TiN film of Eichman et al. by routine experimentation in order to achieve a low resistivity titanium nitride film (see Abstract).

In re claim 14, as applied to claim 7 above, Eichman et al. disclose all claimed limitations including the limitation wherein, in the first step, the nitrogen-

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containing reducing gas is set at a flow rate of 20 mL/min or more (see col. 3, lines 3-20).

***Conclusion***

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to KHIEM D. NGUYEN whose telephone number is (571)272-1865. The examiner can normally be reached on Monday-Friday (9:00 AM - 6:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew S. Smith can be reached on (571) 272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Khiem D. Nguyen/

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